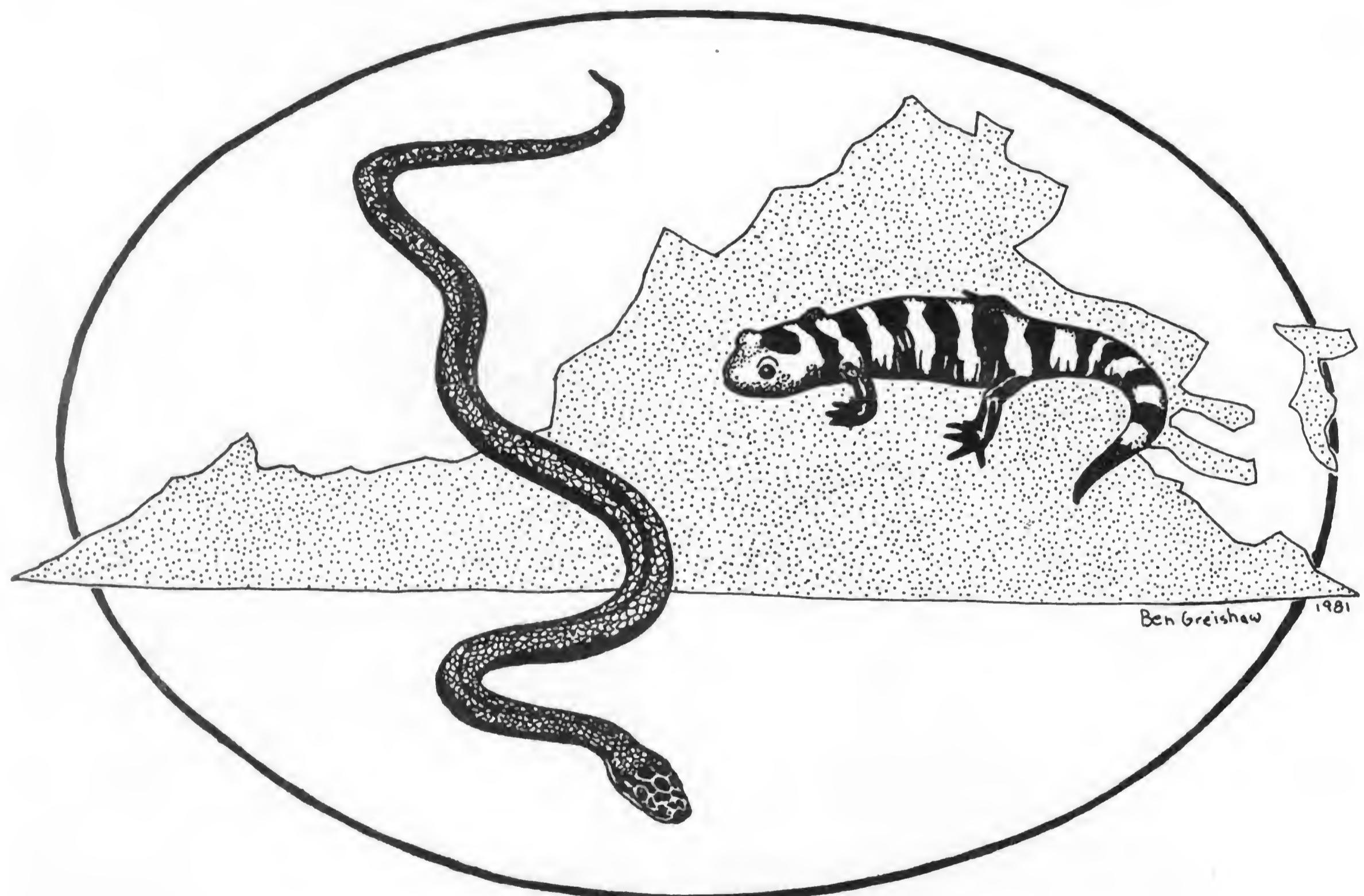


# CATESBEIANA



BULLETIN OF THE VIRGINIA HERPETOLOGICAL SOCIETY

VOLUME 1

1981

NUMBER 1

CATESBEIANA  
BULLETIN OF THE VIRGINIA HERPETOLOGICAL SOCIETY

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BULLETIN INFORMATION

The Bulletin of the Virginia Herpetological Society is issued twice a year by the Virginia Herpetological Society. Membership is open to any individual who is interested in the study of amphibians and reptiles. Membership includes a subscription to Catesbeiana and admission to all meetings. Dues are \$5.00 per academic year, and includes Catesbeiana numbers 1 and 2 of that years volume.

MEETING NOTICE

The next meeting of the Virginia Herpetological Society will be held on October 10, 1981 at Stevens-McCorkle Science Bldg., Longwood College in Farmville, Virginia.

10:00 - 12:00 Exhibits (all members are encouraged  
to bring specimens in appropriate  
cages)  
12:00 - 1:00 PM Lunch  
1:00 - 5:00 PM Paper Presentations  
5:00 - ?? Informal Discussions at McDonald's

Individuals wishing to make a presentation should contact Don Merkle with a tentative title by September 10, 1981. A program will be mailed to all active members who request one.

## EDITOR'S NOTE.

This publication represents the first issue of the Bulletin to appear over the last several years. As many of you are aware, the Virginia Herpetological Society was organized over 20 years ago. For more than the past decade, Frank Tobey has served as both coordinator and editor, and has also tried to keep the Society distributional records current and up to date. Frankly (no pun intended), this was just too much for one person, and the Society has recently begun to divide the work among its members. Frank is now able to devote his time to completing the update on the distribution of amphibians and reptiles in Virginia. This compilation will result in a special publication which should be available to society members early this spring. Details of the publication should be in the next issue of *Catesbeiana*.

You might have noticed that the title as well as the format of the Bulletin has changed. Many of the active members feel that there are enough persons interested in VaHS to support a publication of this caliber. We will continue to publish any notes, articles, etc. that pertain to Virginia herpetology or to herpetology in general. All members of VaHS are encouraged to submit materials for publication to:  
Dr. Donald Merkle, Department of Natural Sciences, Longwood College, Farmville, VA 23901.

One of the primary goals of VaHS has been the collection of distributional information for the herptiles of Virginia. When the updated publication comes out this spring, I am sure that there will be a renewed interest in "filling in" the distributional holes and gaps for each species. In just the past several years, members of VaHS have been responsible for the addition of several new species of amphibians and reptiles to the herpetofauna of the state.

## NEW CHAPTER ORGANIZED IN RICHMOND

The Richmond Herpetological Society (a chapter of VaHS) was formed on 28 May, 1981. Meetings are held every second Tuesday of the month at 7:30 P.M. at the University of Richmond Gottwald Science Center in Room E107. Interested persons should contact: Joe Mitchell (285-6275), Ben Greishaw (282-8892), or Joe Lewis (740-7153).

## NATURE CONSERVANCY REQUESTS VaHS INPUT

The Nature Conservancy is currently looking for suitable tracts of land to purchase to help preserve our biologically unique areas. While they are especially interested in areas that contain critical habitat for endangered species, they are interested in any biologically significant lands. Individuals with suggestions for future land acquisitions should contact: Steve Croy or Tom Wiemboldt, Nature Conservancy, % Herbarium, VPI & SU, Blacksburg, VA 24060 (961-5746).

## DUES FOR VaHS ARE NOW DUE!

Current dues (\$5.00) are now due for the coming 1981-82 year. Dues should be sent to: Mr. Joe Mitchell, Department of Biology, University of Richmond, Richmond VA 23173.

## A KEY TO THE AQUATIC SALAMANDER LARVAE AND LARVIFORM ADULTS OF VIRGINIA

Current knowledge concerning the biology of the salamander larvae in Virginia, and elsewhere, is incomplete. Basic aspects of the life history such as length of the larval period, habitat selection, and food, are unknown for many species. Much of this lack of knowledge may be attributed to difficulty in identification of salamander larvae. The following key is the first guide available to assist in the identification of the larval salamanders of Virginia. This key is not intended to be a synoptic description of larvae but utilizes characters that distinguish species. Two species of possible occurrence (Eurycea gaudridigitata and Ambystoma talpoideum) are included. Conservative taxonomy of Desmognathus is followed in the key and D. wrighti and D. auriculatus are not included. This key will not distinguish among the species in the Ambystoma jeffersonianum complex.

### Sectional Key -

1. Hind limbs absent ..... Section A  
Hind limbs present ..... 2
2. Body very elongate and cylindrical; 1-3 toes, legs appear disproportionately small for body; dorsal pigmentation uniformly dark; 1 gill slit open ..... Section A  
Body not elongated and cylindrical; 4-5 toes; legs appear proportional to body; variously pigmented; 1-4 gill slits open ..... 3
3. Body depressed; skin appears loose; lateral folds present; limbs with folds posteriorly; toes (5) flattened and fleshy; gills absent or if present, thin and transparent ..... Section A  
Not as above ..... 4
4. Four toes present ..... Section A  
Five toes present ..... 5
5. Hind legs larger than front legs; gills short, without ramis and branched from base; 3-4 gill slits unless partially metamorphosed; toes and soles of feet often keratinized ..... Section B  
Not as above ..... 6
6. Dorsal fin extends well onto body, rarely collected from lotic water ..... 7  
Dorsal fin terminates on tail or near tail-body junction; rarely collected from lentic water ..... Section C
7. Four gill slits open unless partially metamorphosed; body slender; head not significantly wider than body; keratinized dental sheath absent; skin of large individuals granular ..... Section D  
Three gill slits open unless partially metamorphosed; keratinized dental sheath usually present; head wider than body and proportionally large; body chunky; skin smooth ..... Section E

### Section A

1. Hind legs absent; 36 or more costal grooves..... Siren lacertina  
Hind legs present; less than 36 costal grooves..... 2
2. Body elongate and cylindrical; dorsal pigmentation uniformly dark;  
two toes present..... Amphiuma means  
Not as above..... 3
3. Body depressed; skin appears loose; lateral skin folds; 5 flattened and  
fleshy toes..... Cryptobranchus alleganiensis  
Not as above ..... 4
4. Snout angular; dorsal fin terminates at tail-body junction; lungs  
present; to 33 cm total length; usually collected in lotic water.... 5  
Snout rounded; dorsal fin extends onto body; lungs absent; to 3.5 cm  
total length; usually collected in lentic water..... 6
5. Dorsum uniformly dark or with small light spots; body long and slender  
..... Necturus punctatus  
Dorsum with at least an indication of a dorsolateral light stripe;  
middorsal area dark ..... Necturus maculosus
6. Thirteen or 14 costal grooves; eye line present.....  
..... Hemidactylum scutatum  
Fourteen to 17 costal grooves; eye line absent .....  
..... Eurycea quadridigitata

### Section B - Desmognathine larvae

1. Total length greater than 20 cm ..... 2  
Total length less than 20 cm..... 3
2. Throat and venter of tail often heavily pigmented; body slender; snout  
slightly truncate in dorsal view; sides of head parallel posterior to  
eyes; tail fin low; dorsum often uniformly dark.....  
..... Leurognathus marmoratus (part)  
Throat and venter of tail seldom heavily pigmented; body chunky; snout  
rounded in dorsal view; head progressively wider posteriorly; typical-  
ly light, medium brown dorsally with small flecks and blotches.....  
..... Desmognathus quadrimaculatus (part)
3. Dorsum uniformly pigmented, at least without well-defined circles or  
stripes..... 4  
Dorsum with either longitudinal light stripes, a dorsolateral series  
of even or staggered light circular spots, or a dorsolateral series  
of light circular spots variously fused with a middorsal light stripe  
so as to produce a scalloped effect..... 5

4. Throat and venter of tail often heavily pigmented; body notably slender; snout slightly truncate in dorsal view; sides of head parallel behind eyes; often uniformly dark above .....  
       ... Leurognathus marmoratus (part)
- Throat and venter of tail seldom heavily pigmented; body chunky; snout rounded in dorsal view; head progressively wider posteriorly; typically light brown above ..... Desmognathus quadrimaculatus (part)
5. Dorsum with a light, even-edged middorsal stripe with a black border ..... Desmognathus ochrophaeus (part)  
     Dorsum marked other than above ..... 6
6. Dorsum uniformly pigmented or with small flecks or blotches .....  
       ... Desmognathus fuscus (part)  
     Dorsum with some indication of dorsolateral light circular spots .. 7
7. Dorsolateral light circular spots fused medially with a middorsal stripe to give a scalloped effect; spots typically staggered and usually bordered laterally by a thin black line  
       ... Desmognathus ochrophaeus (part)  
     Dorsolateral light circular spots even or staggered; spots complete or diffuse medially but not fused with a middorsal stripe ..... 8
8. Dorsolateral series of circular spots contacted laterally by a thin black stripe; spots typically complete and even .....  
       ... Desmognathus fuscus (part)  
     Dorsolateral series of circular spots present but dorsolateral black stripe absent; spots may or may not have distinct margins; often diffuse or truncate medially ..... 9
9. Venter of tail diffusely blotched; angle of mouth within margin of eye; ventrolateral lateral line pores partially or entirely outside of pigment margin; dorsal spots chestnut or orange-brown in life, usually distinct and complete without dark margins.....  
       ....Desmognathus monticola  
     Venter of tail immaculate or uniformly pigmented, not blotched; angle of mouth posterior to eye; ventrolateral lateral line pores totally within pigmented area; dorsal spots often indistinct anteriorly; often staggered, often with dark margins and diffuse medially ...  
       ..... 10
10. Body chunky; snout rounded in dorsal view; light brown dorsally with dark flecks and blotches; head progressively wider posteriorly .....  
       ... Desmognathus quadrimaculatus (part)  
     Body slender; snout truncate in dorsal view; often uniformly pigmented dorsally; sides of head parallel posterior to eyes.....  
       ... Leurognathus marmoratus (part)

Section C - Plethodontid larvae with five toes

1. Sixteen or more costal grooves ..... 2  
Fifteen or fewer costal grooves ..... 5
2. Dorsum uniformly light pink, large individuals may have small dorsal markings; supraoptic lateral line pores arranged in an ellipse; 17-19 costal grooves; collected from caves.....  
..... Gyrinophilus porphyriticus  
Not as above ..... 3
3. Costal grooves 18-19; 6-9 costal folds between adpressed limbs; collected from swampy areas; head depressed; distinct dorsolateral light flecks..... Stereochilus marginatus  
Dorsum with vermiculations, spots, or blotches; supraoptic lateral line pores arranged in a circle; 16-17 costal grooves ..... 4
4. Stout body form; dorsum distinctly mottled or streaked with dark pigment; usually without flecks or blotches ..... Pseudotriton ruber  
Slender body form; dorsum uniformly brown to red-brown with small dark spots, flecks, or reticulations often forming indistinct longitudinal streaks ..... Pseudotriton montanus
5. Dorsum with longitudinal series of light spots ..... 7  
Dorsum without longitudinal series of light spots ..... 6
6. Dorsolateral dark stripe present or lateral surface of body dark .... 7  
Dorsolateral dark stripe absent or lateral surface of body light ....  
..... Eurycea bislineata (part)
7. Gular pigment extends medially immediately in front of first gill; ventral surface of hind foot pigmented ..... Eurycea lucifuga  
Not as above..... 8
8. Dark vertical bars on side of tail or this area uniformly dark; usually 13 costal grooves ..... Eurycea longicauda  
Dark vertical bars on side of tail absent or this area not uniformly dark; usually 14 costal grooves ..... Eurycea bislineata (part)

Section D - Salamandrid larvae

1. Greatest diameter of eye less than distance from eye to nostril; green to yellow green in life; venter yellow, dorsum with conspicuous light circles; dark spots on tail ..... Notophthalmus viridescens

Section E - Ambystomatid larvae

1. Chin and throat heavily or lightly pigmented..... 2  
Chin and/or throat immaculate..... 3
2. Costal grooves 10-11; chin and ventral surface lightly pigmented; longitudinal dark stripes on ventral surface .... Ambystoma talpoideum

2. (Continued)
- Costal grooves 11-13; throat evenly pigmented; ventral surface with small dark spots; numerous lateral light spots..... Ambystoma opacum
3. Dorsum uniformly dark with numerous small light flecks; maxillary teeth in a single row ..... Ambystoma mabeee  
Not as above ..... 4
4. Paired dorsal black spots or blotches present ..... 5  
Not as above ..... 6
5. Paired dorsal black spots separated by a middorsal black line; midlateral row of separate or partially fused light spots; head very large; body short and stubby ..... Ambystoma jeffersonianum  
Distinct dorsal black spots in individuals less than 6 cm total length; ground color highly mottled to uniform grey; costal grooves usually more pigmented than costal folds; lateral light band and row of lateral light spots on most larvae less than 6 cm total length; toes flattened ..... Ambystoma tigrinum (part)
6. Dorsum uniformly dark or heavily pigmented with large dark blotches with or without row of dorsal light spots; midlateral band of fused yellow spots; less than 5 cm total length ..... Ambystoma maculatum  
Not as above; greater than 6 cm total length.....  
..... Ambystoma tigrinum (part)

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## NOTES ON MALE COMBAT IN TWO VIRGINIA SNAKES, AGKISTRODON CONTOURIX AND ELAPHE OBSOLETA

Male combat, ritualized behavioral interactions between males (Carpenter and Ferguson, 1977), has been reported for several snake species. This behavior has been correlated with sexual size dimorphism where large male size is selectively advantageous in intrasexual competition (Shine, 1978). Most of the reports of male combat are based on observations of captive animals (Shaw, 1948; Gillingham, 1980). Few field observations exist. This note discusses some observations made known to me recently concerning male combat in two species of Virginia snakes.

A pair of male Elaphe obsoleta were observed fighting (entwined with heads raised) near Herndon, Loudoun Co., Virginia on 27 May, 1966 by William M. Martin, III. The snakes were 185 cm and 168 cm in total length. A female E. obsoleta (155 cm) was located nearby. Although detailed observations were not made, the information certainly suggests male combat. This behavior has been described by Rigley (1971) who observed a

a similar instance in West Virginia on 15 June, 1969. Members of the genus Elaphe entwine most of their extended and prostrate bodies and keep their heads close together, either prostrate or elevated horizontally above ground (Carpenter and Ferguson, 1977). Additional observations of male combat in this species were noted by Stickel, et al. (1980) in Maryland; 22 May, 1951, 12 June, 1952, and 27 May, 1955. These field observations correlate well with the known mating period of spring (Fitch, 1963).

On 3 August, 1980 two Agkistrodon contortrix were killed by E.F. Sebolt in his backyard off Dorchester Road in southwestern Richmond. The next day I found the decomposing carcasses to be males, 90 cm and 85 cm total length. When questioned about the incident, Mr. Sebolt said the two snakes were entwined about each other and were oblivious to his presence. No other copperhead was seen nearby. Each snake had copious amounts of sperm suggesting that they were reproductively active at this time. The only field description of male combat for A. contortrix was published by Gloyd (1947) who recounted a description of an incident told to him by J. Ackroyd who witnessed it near Winchester in late June, 1945. Crotalid snakes (including Agkistrodon) elevate and loosely entwine their anterior trunks and hold their heads in a near vertical position (Carpenter and Ferguson, 1977). Mating in A. contortrix occurs in spring and late summer (Fitch, 1960), the latter period correlating with two Virginia observations.

Reasons for the onset of this behavior remain obscure, primarily because so few observations are available. Perhaps some visual signal stimulates the behavior when two males encounter one another. Hormone levels during a key phase of the spermatogenic cycle may play a role. It has also been suggested that male combat is associated with territoriality, social dominance or competition for a mate or food (Carpenter and Ferguson, 1977). Additional detailed descriptions of this behavior in the field and lab are needed to elucidate its causes and the extent to which it occurs. How common is this behavior in Virginia?

Acknowledgements: I thank W.M. Martin, III for making his observation known to me, and E.F. Sebolt for calling me about the copperheads.

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## ON THE OCCURRENCE OF PSEUDACRIS BRACHYOPHONA (COPE) IN VIRGINIA

The mountain chorus frog, not recorded from Virginia prior to 1943, is known to be widespread west of the New River in this state and is exceptionally abundant in suitable localities.

My own experience with brachyphona extends back for three decades, of which the first two witnessed only very casual encounters. Beginning around 1970 a more deliberate attempt was made to accumulate distributional data, and the results to date are represented in the accompanying map (Figure 1). I hope to continue documentation of this kind whenever possible and would like to invoke the interest of others to participate in the effort. Perhaps a short summary of the more interesting biogeographical local aspects, and some general impressions about the status of brachyphona in Virginia at present may prove useful in this respect.

Reference to the map in Conant's Field Guide (1975) and a more detailed spot map in my account (1980) in the SSAR "Catalogue" shows that the majority of the range of brachyphona lies within the Appalachian Plateau Physiographic Province, and that through Tennessee, West Virginia, Maryland, and Pennsylvania its area seems limited by the eastern boundary of that geomorphic unit. Only in a part of southwest Virginia - in the region of Tazewell, Wytheville, and Marion - does brachyphona transgress the boundary and spill over into the Ridge & Valley Province, but it does so there on a grand scale, and even reaches the edge of the Blue Ridge Province at Mount Rogers. Why at this particular region?

It is probably no accident that this part of Virginia contains the divide between the Kanawha and Tennessee drainages, and includes the greatest heights attained in the Ridge & Valley Province. In effect, an archipelago of high ridges and low peaks, standing on a base level of nearly 2500 ft., exists here between the Appalachian Plateau of southern West Virginia, and the Southern Blue Ridge at Mount Rogers. In the

not-too-distant past this region must have provided a kind of ecological continuum of subboreal conditions, in effect a bridge used by cold-adapted organisms extending either southward or northward. Various amphibians have obviously crossed this bridge, as attested by present distributions, notably Desmognathus ochrophaeus (Cope), D. quadrimaculatus (Holbrook), and Plethodon jordani Blatchley. I think that brachyphona may be added to the list, on the basis of its occurrence around Mount Rogers.

The status of brachyphona in the Iron Mountains is one of attenuation, of tiny remote colonies presumably left behind by contraction of the species' range during post-glacial warming periods. The first find was made at Grindstone Campground in the Mount Rogers National Recreation area, about halfway between Konnarock and Troutdale, where a few males were heard calling listlessly (22 May, 1972) from a seepage area with scarcely enough water to cover them. One specimen (USNM) was reluctantly taken for the record. On the same evening, a drive to Konnarock and back revealed no calls other than those of Hyla crucifer, nor have subsequent trips to Grindstone; I do not know if the colony still exists. Another small colony, with never more than a dozen males calling at once, exists on the headwaters of Nick's Creek, 3 miles south of Atkins on County Rt. 622, Smyth County. Calling was first noted here on 25 March 1973 and heard sporadically since then.

On 31 March 1973, a warm rainy day with thunderstorms at night, a few brachyphona were found calling among numerous crucifer in a roadside ditch along County Rt. 670 about 3 miles west of Teas, Smyth County; later that evening four of five were found but not collected in muddy puddles in the road from Iron Mountain Gap (Va. Highway 16) to Hurricane Camping Area, southwest of Sugar Grove. A transect into Grayson County, from Sugar Grove to Grant and back through Troutdale showed both crucifer and Bufo americanus to be numerous and active, but no Pseudacris of either species were heard at any time.

It seems reasonable to assume that brachyphona may have formerly extended still forward southward through the Iron Mountains, and small colonies may yet be located in those counties bordering the North Carolina Tennessee state line. There is in fact an old and ambiguous citation for Johnson County, Tennessee which invites confirmation (Sinclair, 1957). All of the localities mentioned so far lie within a relatively small area and are considered disjunct. The valley of the Middle Fork Holston River appear to be occupied exclusively by Pseudacris triseriata feriarum (Baird).

To the north and west, however, the situation changes substantially. The far southwestern counties (Wise, Dickenson, and Buchanan) appear generally well-inhabited by the species, and although there are no records for Lee County there is little doubt that brachyphona occurs there, north and east of Pennington Gap. As the map shows, both Russell and Tazewell counties appear to be avoided and although this situation may be partly due to collector apathy there is another explanation to be mentioned later.

The effective southeasternmost boundary of the range is, however, rather sharply defined and this precision is due to collector bias as well as local abundance of the subject. With the exception of one locality (5 miles west of Wytheville on U.S. Highway 52) there are no known

occurrences of brachyphona in the New-Tennessee segment of the "Great Valley"; the two series of almost contiguous spots occur in the valleys of the North Fork Holston River (Smyth and Washington counties) and Little Walker Creek (Wythe and Pulaski counties). In the latter region brachyphona is exceptionally abundant; on 22 March 1974 on a warm rainy night, I was never out of hearing of a chorus during a drive from I-77 at the Big Walker Tunnel east along County highway 601 to the intersection with Virginia highway 100 in western Pulaski County, a distance of about 35 miles. A decade of annual search has so far failed to disclose brachyphona east of Rt. 100 (!) in either Pulaski or Giles counties. The species clearly does not extend to the New River.

In the opposite direction, brachyphona follows the valley of the North Fork Holston River from about the Bland County line to the vicinity of Broadford, where a hiatus of some miles occurs and P. t. feriarum replaces brachyphona. The species is again abundant along County highway 689 from Brumley Gap to Holston, in Washington County. Lastly, there is a single, but unmistakeable, sound record along County highway 802, 3 miles northeast of Mendota, following a heavy thunderstorm (6 June, 1979).

The situation in nearby West Virginia is interesting and merits comment: although brachyphona is almost ubiquitous over most of the state it appears to be largely if not completely replaced in the Greenbrier Valley by P. t. feriarum.

P. brachyphona is, in at least this part of its range, obviously partial to wooded situations in contrast to the open meadow-marsh-roadside ditch habitat preferred by feriarum. It ascends to much higher elevations (nearly 4000 ft. at Grindstone Campground) than its congener although there is some overlap in this respect. Even where, as along Little Walker Creek, brachyphona appears almost ubiquitous, woodland is not far from the fields and ditches.

The already-mentioned lacuna in Russel and Tazewell counties has a smaller counterpart in southern Bland County; the long valley transversed by Virginia highway 42 lying west of Big Walker Mountain. In both places the dominant rock type is limestone, which plays an important part in shaping the distribution of brachyphona in two ways: (1) limestone regions tend to be cleared for pasture and cultivation, and (2) there is, even in wooded locales, less standing surface water over such substrates. On the night of 31 March 1973, a drive up the North Fork of the Holsten revealed plenty of choruses right up to the point where Rt. 42 crossed the line from Smyth into Bland County, and in doing so left a shale region for the above-mentioned limestone valley. I suspect that if brachyphona occurs in Russell County at all, it will be along its eastern and westernmost edges which are mountainous, forested, and not underlain by limestone.

Although brachyphona overlaps widely with triseriata in Kentucky and Alabama, it has long been known that the two are mutually exclusive in West Virginia and Pennsylvania. It is true also in Virginia, where I have found them together at only two places (one apparently extremely ephemeral). Along County highway 601 near Long Spur, in extreme southeastern Bland County, one feriarum was heard calling from a roadside ditch in March 1973, but none since that time; the region supported large populations of brachyphona. The feriarum may have been a chance migrant from central Pulaski county where the species is abundant west and north

of Pulaski.

Both species were calling from a shallow roadside puddle along Route 42 (at intersection with County highway 628) east of Broadford on 31 March 1973. West and south of this site (e.g., Broadford, Saltville, Chilhowie) only feriarum was heard; to the east along Route 42, only brachyphona. What ecological or physiological factors induce such precise exclusion in one part of a species' range and not in others? The inference I draw from local observations is that the range of brachyphona is presently contracting, and its place is being taken over at least at lower elevations by incursions of the lowland and warm-adapted feriarum.

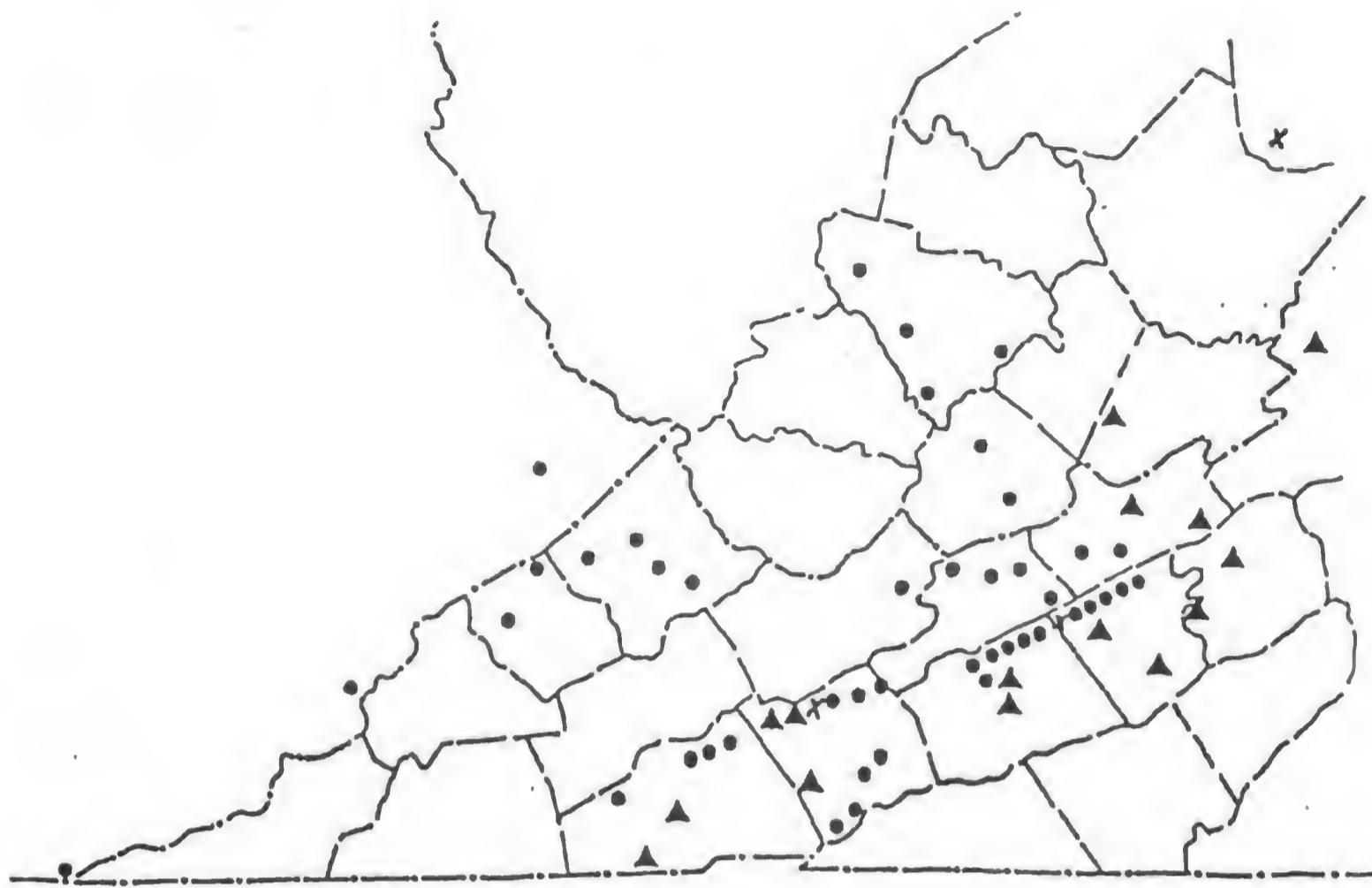
Lastly, an interesting geographic variation in seasonality may be noted. Along the southern edge of the Virginia range (e.g., in Bland, Wythe, Smyth, and Washington counties) calling and oviposition are absolutely confined to early spring (February to mid-April). Even the enormous population along Little Walker Creek obeys this limitation. Yet further to the west, mating activity extends well into the summer; I have found fresh egg masses and heard calling at Grundy, Breaks Interstate Park, and Clintwood in July (at the latter place calling with Hyla chrysoscelis (Cope), and Barbour (1958) states that oviposition occurs even in August in extreme eastern Kentucky. These two seasonalities occur only 100 miles apart, and the curiosity of ecologically-oriented herpetologists certainly ought to be piqued by such a situation.

Although the limits of the range of brachyphona in Virginia now appear to be rather closely circumscribed, obviously there remains plenty to do with respect to working out details of its natural history.

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**Figure 1. Distribution of the genus Pseudacris in western Virginia.**  
 Solid dots indicate records for P. brachyphona while triangles represent records for P. triseriata feriarum. The two localities in Virginia and one in West Virginia where the two species are sympatric are indicated by the symbol X. The absence of both species from Floyd, Carroll, and Grayson counties is noteworthy and is substantiated by 30 years of almost annual spring observations.

#### PILLSTROM TONGS ARE STILL AVAILABLE :

Despite repeated rumors that Pillstrom tongs are no longer available, I am happy to report that these "necessities" for capturing snakes are still-available. However like everything else the price for the 36 inch standard model has risen to \$35.00 plus \$1.83 for shipping to Virginia. Orders should be sent with payment to: Pillstrom Tongs, 4617 Free Ferry Road, Ft. Smith, Arkansas 72903. Other sizes are available.

#### THREE VIRGINIA BIOLOGISTS SPEAK AT NATIONAL HERPETOLOGY MEETINGS

Recently at the annual meetings of the Society for the Study of Amphibians and Reptiles and the Herpetologists' League held at Memphis State University, three Virginia biologists presented papers for which abstracts appear on the following page. Next year the meetings will be held August 1-6, 1982 in Raleigh, North Carolina so we will expect to see a lot more VaHS members present. Details of the meetings will be in the next issue of *Catesbeiana*.

Andrews, R.M. and Rand, A.S.

Department of Biology, Virginia Polytech Institute and Smithsonian Tropical Research Institute

#### INTRASPECIFIC VARIATION IN EGG AND HATCHLING SIZE OF ANOLIS LIMIFRONS

Egg and hatchling weights were measured for Anolis limifrons females in Panama. Females laid an average of 5 single egg clutches during the observations. Variation in egg and hatchling size was evaluated with regard to female size, season in which eggs were laid, and presence of malarial parasites in the blood. Egg and hatchling size were greater in the dry than the wet season, but unaffected by female size or malarial parasites. Females differed from one another in mean egg and hatchling size.

Brooks, Garnett R.

College of William and Mary

#### ECOLOGICAL SIGNIFICANCE OF SEXUAL DIMORPHISM IN BODY SIZE IN ANOLIS LIVIDUS.

Anolis lividus is a solitary species on Montserrat, W.I. Adult males weigh 8-9g, have a snout-vent length (SVL) of 68-72 mm, and are 3.5 times heavier and 1.5 times longer than adult females. Data on structural habitat and prey consumption were obtained for 316 individuals collected over a four month period. Over 60% of the adult males (SVL  $\geq$  56 mm) were on perches  $> 1$  m; 70% of both males and females with a SVL of 41-55 mm were on perches  $< 1$  m, and 90% of both small males and females (SVL  $\leq$  40 mm) were on low perches ( $< 50$  cm) or on the substrate. The mean number and mean length of prey for males and females was 19-20 and 2.9-2.4 mm respectively. In both sexes; (1) mean prey length, but not mean number of prey, was positively correlated with SVL ( $r = .74$  for males; .99 for females), and (2) in all size groups over 88% of all prey were  $\leq 5$  mm. There was no significant difference between males and females of similar size in regards to mean length or mean number of prey. These results differ from those found by Schoener (Science 155: 474-477, 1967) for the solitary species, Anolis conspersus. It appears that similar sized males and females of A. lividus utilize similar structural and trophic niches.

Ortiz, Peter, and Jenssen, Thomas

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#### AGGRESSIVE BEHAVIOR BETWEEN LIZARD COMPETITORS, ANOLIS COOKI AND A. CRISTATELLUS

The Puerto Rican A. cooki (CO) and A. cristatellus (CR) have broadly overlapping niches and appear to be vigorously competing for perch sites in areas of syntopy. To evaluate the intensity of the interspecific aggression, six classes of paired encounters were run in the lab using the following Puerto Rican Anolis: (1) CO - CO; (2) CR - CR; (3) CO - CR; (4) CO - monensis\* (a cookii look-alike); (5) CR - gundlachi\*\* (a cristatellus look-alike); and (6) CR - evermanni\*\*\* (a totally unique appearing congener).

The most intense encounters were for classes 1-3; these values were significantly greater than for classes 4-6. Intensities for 4-6 were of similar low values, including the look-alike pairings. It was concluded that the intense interspecific aggression between CO and CR is more likely explained by the fact that they "recognize" each other as territorial competitors than by the hypothesis that they are mistaking each other as conspecifics.

\*allopatric; \*\*non-syntopic; \*\*\*non-syntopic

## THE CAPTIVE MAINTENANCE OF VIRGINIA'S WATERSNAKES

Virginia has five species of watersnakes most of which have been neglected in live collections. These species are the Northern watersnake (Nerodia sipedon), the Brown watersnake (N. taxispilota), the Red-bellied watersnake (N. erythrogaster), the Glossy watersnake (Regina rigida), and the Queen snake (R. septemvittata). Once handled, it is not difficult to see why watersnakes are often neglected in captivity. When first caught, most specimens are quick-tempered biters which excrete a noxious fluid from glands at the base of the tail while thrashing wildly about. But in my experience, most specimens settle down in time and seem to adapt to a proper captive environment.

Watersnakes in general are known to be carriers of many serpent diseases and therefore may not be a good choice for the keeper having valuable specimens. If captive-bred stock can be obtained, they are less likely to carry serious parasites or diseases. Wild-caught specimens kept in a proper captive environment have lived for many years.

Because they have been neglected in collections, much remains to be learned about the captive husbandry of this group, especially where reproduction is considered. Many major zoological institutions still have the attitude that watersnakes are more easily re-collected from the wild than bred in captivity. This fascinating group of snakes deserves more attention from the serious reptile keeper.

### ACQUISITION

Specimens may be acquired by purchase or by collection from the wild. Unless the actual collection site of a purchased specimen is known, I recommend the capture of wild specimens. Precise locality data should be kept on all specimens. An important point to remember is that all animals that are released back into the wild should always be released at the original capture site. Since snakes acquired from many animal dealers or pet stores are often of unsure origin and health, unless a reputable dealer can be located, collection from the wild is the best source.

Nerodia sipedon, erythrogaster and taxispilota can be found in southeastern Virginia. Nerodia sipedon is found statewide as well as in a diversity of wetland habitats.

The glossy watersnake is known in Virginia from only one locality. Nothing is known about the biology of this species in Virginia and conservation-minded acquisition of this species could add much to our knowledge of its natural history. Specimens should be released at their site of capture after completion of a captive term.

The Queen snake, R. septemvittata is not recommended for any but the most serious herptile keepers. Their specialized diet of soft-shelled crayfish makes them difficult to keep. This species may be captured in streams throughout the Piedmont and mountainous areas of the state.

### HOUSING

Unlike the name "watersnake" implies, these snakes should be kept in a dry cage situation with only drinking water supplied. If a large area is

used to house watersnakes, a swimming area can be designed such that the water can be kept clean and the snakes can have access to a dry section of the exhibit at all times. Watersnakes that are kept in cages that are too wet soon develop a disease commonly called "blister disease". If not caught in the early stages, this disease is usually accompanied by respiratory infection, scale rot, and often mouth rot. Death of the specimen is the usual result.

It is preferable to give captive specimens as much room as possible; however, a tightly covered 10 gallon aquarium will house several juveniles, 2 or 3 medium sized, or 1 large watersnake. Many keepers prefer custom built cages that open from the side. The important thing is that the cage be made of a material which allows easy cleaning and will withstand disinfectants.

Cage substrates is a topic often discussed among reptile keepers. But most agree that where looks don't count, newspaper is as good as any material. It is readily available, absorbent, and cheap! I have found that it is good practice to change the newspaper whenever soiled and to scrub and disinfect the whole cage once a week. Watersnakes are not known for their neatness and it is frustrating how quickly they can soil a just-changed cage.

Heat and light can be supplied with incandescent light bulbs, of sufficient wattage to maintain a daytime cage temperature of 25.5° - 29.5° C (78° - 85° F). The temperature can be allowed to drop to 18°C (65°F) at night. The effects of lights that imitate the sun's rays are still unknown with some reptiles. One can be assured that it will not hurt the snakes and may do them some good, especially for basking snakes such as watersnakes. Such lights come as fluorescent tubes under the name Vita-Lite (Durotest Corp.). If fluorescent lights are used, another source of heat will be required. A light cycle can be set using 14 hours of light and 10 hours of darkness daily, though ideally a natural photoperiod should be offered.

#### FOOD AND FEEDING

In the wild watersnakes are known to eat frogs, toads, fish, tadpoles and salamanders. If it can be supplied, a natural and varied diet is the best. However, this is usually not possible in a long-term captive situation and a suitable substitute must be found. Minnows may be captured and frozen for later use as may other kinds of fish (Do not store more than 6 months in the freezer!). Smelt can be obtained in an efficient size which does not have to be cut for subadult or adult snakes. Some professional zookeepers however do not think that saltwater fish should be fed regularly to watersnakes.

Members of the genus Nerodia will fight over food and can cause injury or death to cagemates while trying to swallow a common piece of food. Watersnakes are best fed individually. This is especially important when snakes of different sizes are involved. Some keepers hand feed their snakes while others separate them and feed them individually.

In my experience, watersnakes will eat to obesity, especially N. sipedon and N. erythrogaster. In that condition they are lethargic, prone to diseases, and unlikely to reproduce. Carefully watch the weight

of captive specimens and adjust the amount of food accordingly. This is another good reason for feeding snakes individually. Remember that most captive specimens utilize far less energy than their wild counterparts. One feeding per week is enough for most adult snakes.

#### BREEDING

For most species of reptiles breeding in captivity is the exception. This is especially true for watersnakes. Most births in captivity are due to the efforts of gravid wild-caught individuals rather than captive matings. The lack of success in breeding watersnakes is due in part to a lack of effort, but also due to a general disturbance of physiological stimuli in the move from the wild to a captive situation. This is part of the reason wild-caught individuals are so difficult to breed whereas the young born in captivity, when mature, breed more easily. Much more research is needed to discover just what factors are being altered thereby upsetting the natural reproductive cycle of snakes in captivity.

For the best chance of success and for ease in keeping accurate records, it is best to house sexes separately. Females may be periodically introduced to single males. If mating occurs, both parents are known. This is important for the maintenance of long-term breeding stock. The best time for introduction is immediately after the female sheds. The moist new skin seems to excite the male. Under artificial conditions, mating can be accomplished at any time of the year. Four or five weeks after mating, the owner should be able to feel a series of lumps while allowing the female to glide through his fingers while exerting a gentle pressure. The gestation period is usually more than 100 days.

When the female is near the birth date she should be housed alone and the temperature allowed to cool more often. A quantity of sphagnum moss should be provided and kept damp (Not wet!). Females often become restless just prior to birth. It is advisable to handle gravid snakes as little as possible especially near the birth date.

As soon as possible after birth, the baby snakes should be removed. This eliminates the possibility of accidental injury by the female. They can be left undisturbed in their new cage for a few days. The first job will be to get them to accept their first meal. Live fish such as Mosquito fish (Gambusia) are ideal. They can be left in the water bowl. The smell and motion of the live fish seems to attract the young snakes. Most will learn to eat on their own. I have found that bits of smelt are also readily taken within two weeks of birth. With the young snakes it is very important that the bones of the fish be left for the snake to eat. In addition it is recommended that small quantities of bone meal be sprinkled on the fish or fish strips.

Under captive conditions, Robert Riches (1976) has raised snakes to maturity in surprisingly short times. It can be expected that captive snakes will reach maturity by their second year if they are maintained at constant temperatures year round.

#### RECORD KEEPING

It is hoped that every reptile owner understands the importance of

breeding their captives. Just as important however are the records kept on snakes. Much is to be learned about the behavior of Nerodia species in captivity. In most cases, behavior is undescribed or at least insufficiently described. Records should be kept on every individual housed in a collection. Age, locality data, sex, food taken, growth records, shedding dates, health data, reproductive records, behavior records, ad infinitum should be recorded. Such information should be kept in an organized fashion and written down! Trust nothing to your memory. Then share it with others who are interested in the same subject.

Herpetologists in Virginia are fortunate to have several species of watersnakes as residents. They are uniquely adapted to survive in an aquatic or semi-aquatic environment. Much can be learned from them in captivity and they certainly provide a challenge. It is hoped that more interest will be taken in the captive husbandry of this fascinating group of snakes.

#### LITERATURE CITED

Riches, R.J. 1976. Breeding snakes in captivity. Palmetto Publishing Co.

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#### ENVIRONMENTAL ALERT

Back Bay National Wildlife Refuge, Virginia Beach, Virginia is once again in the center of a raging environmental battle. With the new administration in Washington, D.C., environmental problems are once again popping up. After long court battles, unnecessary vehicular traffic along the beach of Back Bay National Wildlife Refuge was eliminated. Now the Department of the Interior, under James G. Watt, is considering reopening these beaches to as many as 300 additional vehicles (non-permanent property owners on the Outer Banks of North Carolina). Among many other environmental concerns, this stretch of beach is the only available egg-laying habitat in southeastern Virginia for the Loggerhead turtle (Caretta caretta). You are urged to write the Department of the Interior, c/o James G. Watt as well as your congressional representatives to urge that Back Bay Wildlife Refuge be preserved for its unique community of plants, animals, as well as its physical geography - not abused for the convenience of a few landowners. If you need more information, please contact: Chris Pague, Zookeeper, Lafayette Zoological Park, 3500 Granby St., Norfolk, VA 23504

FRONT COVER: Elaphe o. obsoleta and Ambystoma opacum by Ben Greishaw.